ON THE SURGICAL MANAGEMENT OF GENITO-URINARY CALCULUS.[1]

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A. STONE IN THE KIDNEY.

I. *Diagnosis; Indications for Surgical Treatment.* By Joseph D. Bryant, M. D. Surgeon to Bellevue and St. Vincent's Hospitals

THE diagnosis of stone in the kidney implies the consideration of its signs and symptoms, which terms will be employed synonymously by me to-day. The term "stone" is construed to mean a concretion that has a more pronounced individuality than sand, gravel, etc. Stone in the kidney may be either of primary or secondary formation. Primary deposits depend more for their existence upon the inherent or acquired tendencies of the patients than on the accidental influences of their every-day environment. Secondary deposits happen as a sequence of pre-existing stone and also as a consequent complication of pyelitis, cancer, and other structural diseases of the kidney. It follows, therefore, that the history of the symptoms of stone in the kidney will be modified somewhat by the morbid state of the kidney at the time of the stone's inception; that is to say, the symptoms referable only to stone will precede,

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rather than follow, the symptoms characteristic of the diseases of the kidney associated with stone development. The existence of stone in the kidney is often exceedingly difficult to diagnosticate, as the following examples will show:

A stone may develop, pass from the kidney to the bladder, and escape through the urethra without causing any disagreeable manifestations; provided, of course, that it be small as compared with the channels through which it passes. A stone of large size may be found in the kidney after death, without it having caused symptoms even suggestive of its pre-existence. And, too, the difficulty of diagnosis is emphasized in no uncertain manner by the fact that it not infrequently happens that operative procedures fail to disclose the presence of stone in the kidney, even when convincing symptoms point with seeming certainty to its existence there.

It is an established fact that the symptoms of stone in the kidney depend much more upon the size, situation, roughness and mobility of the stone for their presence and prominence than on the fact of the mere existence of this unwelcome tenant in the kidney. The presence of a smooth or immovable stone, irrespective of its size, is less pronounced than that of a small movable rough one. A rough or movable stone, irrespective of size, commonly asserts its presence by causing pain and pronounced modifications in the character and flow of the urine. A small rough stone immovably fixed in the kidney structure, may cause persistent and annoying direct and reflex pains, even though the concretion be so small as to escape the best directed methods of manual and operative technic. A movable or immovable stone, with pronounced asperities, located in the central cavity of the kidney, will cause much severe general and reflex pain, and will also quickly cause changes in the appearance of the urine, dependent on the presence of pus, muco-pus, blood, etc. Small movable stones, whether smooth or rough, will frequently block the flow of urine from the kidney If small enough, they pass from the kidney sinus with much pain and difficulty through the ureter into the bladder; if too large to thus pass, they either block the ureter temporarily or permanently, or they return to the kidney sinus.

The suggestive symptoms of stone in the kidney, together with the convincing ones, constitute a rational order of arrangement which, it seems to me, will lead most surely to a correct diagnosis. A "suggestive" symptom of stone in the kidney may be defined to be a symptom, the presence of which leads the physician to *suggest* the possible existence of stone; a "convincing" symptom of the same condition causes him to assert its probable existence and to advise some surgical procedure to establish its actual presence.

When the solid constituents, which are usually found in solution in the urine. become excessive, and for this reason are deposited in a crystalline form and thus pass from the body, we are then in a presence suggestive of the possibility of stone formation, especially if at the same time there be found tangible evidence of pus, muco-pus, blood or other plastic elements in the same specimen. The more decided and continuous are these manifestations, the more significant they become; and soon attacks of renal pain, varying in intensity and character signal the occurrence of a tangible union of the organic with the inorganic constituents in the formation of stone in the kidney of greater or less size. Aching lumbar pain, vesical irritability, wandering pains in the loins, urethra, upper part of the thigh, and of the testicle; retraction, attended with hyperæsthesia of the latter; each of these suggest the existence of stone in the kidney, especially if associated with the general evidences of chronic indigestion, nervous prostration, or those of a lithæmic state.

Now, indeed, with such a history, we are well nigh convinced of the probable existence of stone in the kidney. However, the chain of suggestive evidence thus forged may melt away, with or without treatment, leaving us free to expect final cure, or to dread the existence of an ambushed foe.

Whether a stone has formed at all, or whether it continue to increase in size, depends on the mutual affinity of the saline and colloid constituents of the urine for each other. Unfortunately, however, for the prospects of arrest of development or of cure at this time, many of the suggestive symptoms already mentioned imply changes in the kidney structure which are themselves conducive of stone formation. True it is, that inorganic elements of the urine may be present in an excessive amount, indefinitely, and yet be unattended with stone formation. It is true likewise that the organic elements may exist in similar proportions, with no unfavorable result; moreover, it is strangely true that both of these may be present coincidently in the urine in large amounts and still no union ensues, until finally, for some unknown reason, their hasty and firm incorporation with each other lays the foundation for stone in the kidney. The step from the "suggestive" to the "convincing" symptoms of stone in the kidney is scarcely appreciable it glides from the first to the second class as one passes from youth to manhood—imperceptibly. Exaggeration of the suggestive symptoms with their addenda comprise the convincing ones. Renal colic with its symptomatic phenomena may now be frequent, prolonged and severe; lumbar pain, markedly increased by jolting movements of the body, and perhaps by turning in bed, is more or less constant; the presence of pus and blood in the urine, and the increase or appearance of the latter with unusual body movements is very common, indeed. Renal epithelium, with or without blood-casts, is frequently found; deep pressure at the seat of the kidney causes pain and tenderness, and perhaps discloses the presence of kidney enlargement the fecal pressure of constipation and fecal movements along the contiguous colon, cause pain of a hyper-sensitive or distended kidney. Finally vesical lavage, and the use of the cystoscope, will establish the fact that the abnormal urinary products are foreign to the bladder, and, perhaps they may be seen to enter that viscus through the ureters themselves. Stone may be present in one kidney alone or in both at the same time; the latter is the more frequent condition. It should not be forgotten that the presence of stone in one kidney may occasion reflex pain in its healthy associate, thus causing the surgeon to suspect that both organs be diseased, or perhaps the latter alone. There are other symptoms of a more or less isolated character that are attributable to stone in the kidney, but, unless they are supported by the presence of one or more of the convincing symptoms already mentioned they can rarely be given the weight to warrant active surgical interference. The symptomatic picture already drawn is essentially practical, discussion being sufficiently comprehensive, as it seems to me, for the purposes of this reading. The indications for operative surgical treatment are quite clearly implied by the forcible deductions that can be drawn, after consideration of the "convincing" symptoms of stone in the kidney already stated:

(1) Operative explorative treatment should be advised when the group of "suggestive" symptoms are persistent and annoying and are not mitigated by simpler methods of treatment.

(2) Operative surgical treatment should be urged promptly when the group of "convincing" symptoms indicate pathological kidney changes of irreparable nature, especially if the use of simpler means of cure be attended by no improvement.

II. *The Surgical Treatment.* By Lewis A. Stimson, M. D.

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The operative treatment of stone in the kidney is so recent an addition to the duties and resources of the surgeon that the experience necessary fully to determine the relative merits of various details and procedures, and even, perhaps, of the fundamental methods of operation has not yet been accumulated. Moreover, the complexity of the subject, created by the widely varying pathological conditions, is correspondingly great, and as the limitations of time imposed by the crowded condition of the order of exercises must be respected, it has seemed to me that the obligations of the duty that has been allotted to me could best be met by (1) a rapid review of the indications for treatment in the different conditions of the kidney, and (2) by a detailed description of the methods and procedures by which such indications are to be carried out, grouping them and comparing them from the operative, instead of the pathological, standpoint.

Stone may exist in the comparatively healthy kidney in the form of gravel, or of one or more masses too large to be passed through the ureter or imprisoned in a pouch of the cortex; or it may have been present as a well-defined stone for a sufficient length of time to have induced suppuration of the pelvis and of the substance of the kidney; or it may be present as an incident, an epiphenomenon, in the course of a pyelo-nephritis.

In the first case, that of a healthy kidney with stone present as gravel or in large masses, the indication is to remove the stone either through the natural passages, if that is possible, or by nephrotomy, including in this term incision of the pelvis and incision of the substance of the kidney. Possibly this statement of an alternative is not warranted; it may be that there is no operative means to promote the evacuation of gravel or small stones through the ureter. I have made the statement on the strength of a single case, reported by Le Dentu, in which, after recognizing the presence of gravel by acupuncture, and failing to reach it by incision of the substance of the kidney, he noted the escape through the urethra of several concretions and the complete cessation of the previous severe lumbar pain. It may well be that this was a coincidence, in that the relief was such as has been obtained in a number of cases of nephralgia simulating calculus by simple exposure of the kidney with or without exploratory puncture or division of its capsule.

In the second class of cases, those in which more or less extensive suppuration has been set up by the presence of the stone, the indications are more complex: the stone should be removed; that is clear; but is that all, or shall the kidney also be removed? Shall it be a nephrotomy or a nephrectomy? The answer to this question must be found in the degree of disorganization of the kidney. If there is simply a pyelitis, the removal of the stone alone is indicated; for, with the removal of the cause, the cure of the suppurative process may be expected. If the substance of the kidney has become involved, if several non-communicating abscesses have formed in it, doubt will be felt whether drainage sufficient to permit the cure of the abscesses can be established or whether enough of the gland tissue remains to make it worth while to preserve the organ. The importance of preserving any portion of the gland that may still be functionally competent is so great, in view of the possible future disability of its fellow, that the rule of practice should be, I think, to retain the kidney in the absence of a clear, affirmative reason for its removal. Experience has already made it clear that a secondary nephrectomy, that is, one following a nephrotomy, after an interval of a few weeks or months, is quite as easily executed as a primary nephrectomy, and has a much lower rate of mortality. The greater ease of removal is explained by the reduction in the size of the kidney effected by the nephrotomy and drainage; the lower rate of mortality may perhaps be dependent upon the same cause, or it may be an associated result of undetermined conditions, which led to the execution of a secondary instead of a primary nephrectomy.

In the third class of cases, those in which the stone or stones have formed in consequence of a pre-existing pyelonephritis, their presence can affect the choice of operation only in case the main affection should call for a nephrotomy and not for a nephrectomy. The removal of the stone would then be required in addition, and possibly such removal would be so difficult or necessarily so incomplete that the removal of the entire organ could alone meet the indication.

To summarize it, then, the presence of a stone in a kidney calls for either a nephrotomy or a nephrectomy; and we have next to examine the details of those two operations.

The kidney can be explored, incised, or removed through the peritoneal cavity (the trans-peritoneal method) or through the loin (the extra-peritoneal method), or by a combination of the two.

It is so generally admitted that the extra-peritoneal method is to be preferred as the safer, and the field of the trans-peritoneal method is so steadily becoming more and more restricted to a few non-calculous affections, that I shall say nothing about the latter, except that the incision into the cavity is best made along the outer border of the rectus abdominis, and the second incision of the peritoneum made on the outer side of the colon, so as not to injure the vessels supplying it. Of the method which combines the two incisions I shall only say that it has been successfully employed in several cases by Thornton; he explores the kidney through the peritoneal cavity, determines the presence of a stone by touch, and then, while fixing the kidney with a hand in the abdomen, cuts down upon it through the loin by a small incision, carries the knife through the kidney-tissue to the stone, and extracts the latter with forceps. It is quite possible that the anterior peritoneal incision, in competent hands, adds but little to the risk of the operation, and that the objections to it which so promptly suggest themselves are not fundamental or important; but still it appears that the method would be efficient only in cases of a single small stone in a comparatively healthy kidney, and that it would probably be inferior to the posterior operation, both as an aid to diagnosis and as a therapeutic measure, when multiple stones or abscesses were present or when the stone was large and irregular.

The posterior route, then, is the one to be preferred, and the operation will be wholly extra-peritoneal, except in certain cases.

The incision. This may be longitudinal, along the border of the sacro-lumbalis, or transverse between the rib and the ilium, or a combination of the two. If the former is used the patient should be placed in a position that is inclined 30 or 40 degrees from the prone toward the opposite lateral, and the trunk should be laterally flexed so as to increase the space between the twelfth rib and the crest of the ilium on the side of the operation. If the transverse incision is used the inclination toward the opposite lateral position may advantageously be greater.

The *longitudinal incision* is made along the outer border of the sacro-lumbalis mass, which can be readily recognized by the finger, about two-and-a-half to three inches from the median line, and should extend through the skin from the level of the eleventh rib to that of the border of the ilium. It is deepened, layer by layer, until the strong middle layer of the lumbar fascia, or aponeurosis of the transversalis, is reached, after dividing which the posterior surface of the quadratus lumborum is exposed. The outer border of this muscle is cleared and drawn toward the spine, and then the fat enveloping the kidney can often be seen through the thin anterior layer of the lumbar fascia, moving up and down with the acts of respiration. Space can be advantageously gained by dividing the outer portion of the quadratus close to its attachment to the ilium. On division of the thin intervening fascia the fatty capsule of the kidney is reached, and by tearing through it and stripping it towards the sides the posterior surface of the middle and lower portions of the kidney and its pelvis is exposed to sight and touch.

Except in persons who are very fat, a condition not often associated with calculous affections of the kidney, this incision gives ample room for exploration and nephrotomy, and even for nephrectomy when the kidney is not very much enlarged. It has the advantages of not weakening the abdominal wall and thereby predisposing to hernia, and of not carrying much risk of opening the peritoneal cavity. On the other hand, the irregular relations of the pleura and the absence or incomplete development of the twelfth rib in a certain proportion of cases expose to accidental wounding of the pleura, a complication that has occurred and has proved fatal. Holl found the twelfth rib absent in three of sixty cadavers examined—five per cent.—a proportion so unexpectedly large that it is now deemed an important precaution to count the ribs before beginning the operation.

A portion of the twelfth rib, and even of the eleventh, has been resected in a few cases in order to gain more room upward, a procedure which, of course, involves additional risk of wounding the pleura. Some room can be more safely gained by drawing the rib forcibly upward with a blunt hook.

The *tranverse incision* is begun just within the outer margin of the sacro-lumbalis, a little below the twelfth rib, and carried outward parallel to the rib for about four inches. The muscular and aponeurotic layers are successively divided, after recognition, until the retro-peritoneal layer is reached, and the kidney exposed by division of its fatty envelope as in the preceding description. Additional space can be gained by a short longitudinal cut at the spinal end of the main incision.

The especial advantages of this incision appear in nephrectomy when the kidney is much enlarged. When the exceptional indication for resort to it arises from the great size of the kidney or from its close inflammatory attachment to the peritoneum, this incision permits an easy and free opening into the peritoneal cavity, through which the hand can be introduced to draw the kidney outward and to facilitate the securing of the pedicle and other later steps of the operation.

The Incision of the Kidney—Nephrotomy—Nephrolithotomy. The kidney having been reached, and its posterior surface and pelvis having been freed as far upward as possible from its fatty capsule, the surgeon proceeds to seek for signs of the presence and location of a calculus. He may be able to recognize it by touch, grasping the kidney between the thumb and finger; or its position under the thinned cortex may be indicated by a rounded bulging of the surface and a deepening of the color; or the stone may be touched with the point of a needle introduced through the parenchyma or the wall of the pelvis. This latter mode of exploration has been proved to be free from serious risk, and when employed should be made systematically so as to explore all accessible portions of the kidney, the needle being introduced at intervals of about half an inch.

The incision for the removal of a stone has usually been made through the posterior wall of the pelvis, and it has been made with the knife rather than with the cautery; but some recent experience has shown that an incision through the substance of the organ into the pelvis has some advantages and does not expose to troublesome hemorrhage. Such pressure as can be readily made by sutures checks the bleeding, and it is believed that a urinary fistula is then less likely to be established than after incision of the pelvis. If the stone lies under a changed and projecting portion of the cortex it should be reached by an incision through the cortex radiating from the pelvis to the convex border.

If the stone is small and free in the pelvis, or in a dilated calyx, or in a pouch formed about it in the cortex, its removal is easy; it may be picked out with the fingers or forceps; but if it is large, irregular, or adherent, its removal may be very difficult; it may be necessary to break it into pieces, to divide intervening septa, or to open into separate, adjoining pouches. For the division of septa strong scissors are probably better than the knife or the cautery. To break a large irregular stone a lithotrite or strong sequestrum forceps may be used. To remove stone from cavities with irregular approaches, scoops of most varied and bizarre shapes have been designed, few of which have received the approval of others than the inventors, and all of which might still leave the surgeon unprovided with the particular shape that was desirable for the case in hand. In a number of the reported cases the surgeon has expressed the opinion, or the autopsy has shown, that stones have been left undiscovered or unremoved.

Occasionally the stone has proved to be so large, or the stones have been so numerous and so difficult of removal, that it has seemed wiser to remove the entire organ, to do a nephrectomy insteady of a nephrolithotomy.

The orifice of the ureter should next be sought and that canal explored to determine whether it is free or whether plugged by a stone or a mass of fibrin. If such an obstruction is found it may, perhaps, be pressed downward into the bladder, or washed out, as was very ingeniously done by Dr. Lange, by a stream of water directed into the distended ureter through the wound.

The stone or stones, having been removed, the incision in the pelvis or in the substance of the kidney may be closed with sutures to hasten its repair and diminish the chance of the establishment of a urinary fistula.

Provision for the drainage of the wound and the prompt removal of urine that may escape into it is made by a rubber drain and iodoform packing; the external wound is partly closed by sutures at its ends, and a large absorbent dressing applied.

Nephrectomy. The details of the enucleation and removal of the kidney vary greatly in different cases, according to the varying conditions of the organ. If inflammation and suppuration have not caused the fusion of the fatty capsule and the cortex into a a single lardaceous layer, or united the kidney closely to the peritoneum or colon, it is comparatively easy after having reached the posterior surface of the kidney, to work the fingers around its convex border and its two extremities and separate it from all its attachments except the sort of pedicle constituted by the renal vessels and the ureter. This pedicle may be ligated in sections, the ligatures being passed by means of a large, full-curved aneurism or pedicle needle, or occasionally the artery can be isolated by sight or touch, and tied separately, or the entire pedicle can be tied *en masse*. If the latter course is followed I think the elastic ligature should be used. In some cases instead of a ligature a long, strong clamp has been placed on the pedicle. In making such an enucleation the operator must proceed with great gentleness, especially at the extremities, where abnormal vessels may be encountered and he must not draw the kidney too forcibly into the wound lest he tear the vessels.

If the kidney is much altered and adherent the need of care in detaching it is still greater. The accidents that have happened are varied and serious: laceration of the peritoneum, colon, and even in several cases of the vena cava with immediately fatal result. When the adhesion of the anterior surface of the kidney to adjoining tissues has been very close it has been successfully practiced to remove the posterior half of the organ and then to scrape away from the remaining cut surface so much as it seemed safe to remove. The healing of the wound may require a somewhat longer time, but that is not an excessive price to pay for the greater security.

If the ureter had been separately divided it is well to close it with a ligature.

The pouch left by the removal of the kidney needs to be drained, packed with iodoform gauze, and protected by a large dressing outside.

It may be well to add that some surgeons, impressed by the desirability of preliminary ligature of the renal artery, have employed and recommended extra-peritoneal approach to the kidney by a longitudinal incision in, or somewhat in front of, the axillary line; when the peritoneum is reached it is stripped back to the kidney and then off its anterior surface until the renal artery is exposed and tied. Enucleation is then completed as in the previous case.

C. STONE IN THE BLADDER.

What special indications should govern a choice of operation as between Lithotomy and Lithotrity. By Edward L. Keyes, M. D., CONSULTING SURGEON BELLEVUE AND CHARITY HOSPITALS.

In the few minutes allowed me for a consideration of this subject, I shall shape my discussion chiefly upon deductions justified by the application of improved modern methods of diagnosis, and upon the crystallization of such experience as it has been my fortune to gather during twenty-five years of active work in the Genito-Urinary field.

Facts are eternal and the premises from which conclusions must be drawn are not changed from what they have always been, but our appreciation of the significance of facts varies. Old conclusions must now be modified by the light thrown from the three brilliant modern foci.

I. The admirable results of litholapaxy as applied to male children.

II. The undoubted triumphs of cystoscopy in perfecting diagnosis, more particularly as to the physical condition of the urinary tract.

III. The accumulating confidence of those who are testing the value of supra-pubic prostatectomy, as a radical measure for the relief of the enlarged prostate.

These three considerations are the only ones I recognize as powerful in modifying our choice of operation, from what it would have been five, or even three, years ago.

This is the day of attempts at exact physical diagnosis. Time was but is no longer, when a reputable surgeon may presume to advocate any one operation as applicable to all cases of stone. The same common sense and logical weighing of his patient's necessities must shape a decision in selecting the operation in this as in any and every other surgical field.

To approach the subject then from its most material side, I ask: Is the size of the stone now a prime factor in deciding the method by which its removal should be undertaken? At the present day and date the answer must be decidedly—No.

Of course small stones are easier to dispose of than large ones, by the lithotrite, and it seems natural that they should receive this method, larger ones being left to the knife. Yet this is so only in a negative sense, namely: a large stone, if large enough to be mechanically beyond the clasp or the strength of the lithotrite, cannot be managed by this instrument; but aside from this the size of the stone is a matter of no significance at all.

In a sort of negative sense even the paradox may be sustained, that the smaller the stone the less is it suited for the lithotrite in any but very expert hands. For one of the slurs cast upon lithotrity by its enemies is that it often leaves behind a last fragment to become the nucleus of a new stone.

Yet if this last fragment, as is the fact, be so hard to find, even by a competent lithotritist, how much more difficult must be the finding of a very small stone, than of a good sized one, by a surgeon inexpert in the use of the crushing instrument—for surely there can be no doubt as to the relative skill required to perform creditable lithotrity as compared with creditable lithotomy.

I demonstrated this in a statistical paper, discussing the value of the then new operation, litholapaxy, many years ago[1] wherein it appeared that the percentage of mortality diminished rapidly as the number of operations by a given surgeon multiplied. At that date the death rate was 2½ per cent. for surgeons having performed five or more than five operations, while it was 13 per cent. for surgeons having performed less than five operations each.

Any competent surgeon who can handle his knife well in general work can perform lithotomy perfectly, but he cannot perform lithotrity well until he has trained his hand by actual experience in a number of cases.

For this reason alone lithotomy is, has been, and justly must always continue to be the more popular operation with the general body of operating surgeons; but beyond this there are also other considerations in modern days throwing the balance in favor of lithotomy.

For, notwithstanding that the statistics of lithotrity (or litholapaxy, for this is modern lithotrity,) are splendid in competent hands, and that in such hands if the stone can be crushed it may generally be safely crushed, yet, even in such hands, the whole question ought to be not does the stone justify crushing, but does the physical condition of the patient and of his urinary tract justify lithotrity?

And this view of the matter should, I think, obtain all through life. The age of the patient has nothing to do with it, and the stone nothing—except in lending itself mechanically to the possibility of lithotrity.

The very exceptionally brilliant results obtained in India by Keegan and by P. J. Freyer, with a wonderfully minute mortality, and repeated with less brilliancy in other countries, show that the very young male infant, even with large calculus, is a most fitting subject for successful litholapaxy.

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[1] Am. Jour. of the Med. Sc., April, 1880.

If the stone in the infant or child be too large for such crushing instruments as will pass his urethra, it is also too large for proper extraction by the perineal route, and the supra-pubic operation is called for; otherwise litholapaxy should always be the operation of choice. For even the male bladder, before puberty, with its dependent orifice and no prostate, needs no surgical drainage—take out the stone by crushing and nature does the rest.

I think it, therefore, safe to say, before puberty in either sex, always crush when practicable; for large stones cut above the symphysis. It is far easier to crush successfully in the smooth bladder of the child than in any other.

In middle life some foreign bodies (glass, pins, pencils, etc.) naturally demand the knife, and the perineal route may be properly preferred, yielding as it does a less mortality than the supra-pubic, and being often as suitable for the detection and safe removal of the offending body.

But aside from such adventitious nuclei, when the stone alone is considered, in the period between early adolescence and late middle age—say fifty—here assuredly, if the stone be very large, the high operation is suitable, while, if it can be dealt with by the lithotrite, it should be crushed and washed out, unless the physical condition of the parts contra-indicates this method.

These physical contra-indications are few, being notably tight, deep urethral stricture, intense, long standing cystitis with altered mucous membrane (needing prolonged rest and drainage,) sacculated stone, or concomitant vesical tumor.

Of these conditions two—urethral stricture and chronic cystitis—call for the perineal operation, the first median with liberating lateral vesical incision if required; the second lateral, the bladder neck being well cut into to ensure prolonged free drainage; while the sacculated stone and concomitant vesical tumor naturally demand the supra-pubic opening. Here it is that the cystoscope lends powerful aid in deciding what course shall be followed.

I do not consider the existence of pyelitis momentous in deciding whether to cut or crush. It aggravates the prognosis in either case.

If the stone be too large for crushing here, as in the child, and for the same reason, the supra-pubic route should be elected.

Finally we come to the old man, and it is here, in my opinion, that modern experience instructs us to reverse some of our earlier conclusions.

Formerly it was exactly in these cases that lithotrity (or litholapaxy) was most ardently advocated, for it was contended that with the large prostate there was no hope of having a healthy bladder, even after cutting, therefore why take the risk of the knife, and if the patient was in catheter-life why not employ the lithotrite, take away one of his sources of irritation and let him keep on using his catheter.

Now, while this argument holds its force still, in the case of those old prostatics whose toughened urethræ make no protest against the frequent introduction of instruments, and who do not fret under this necessity for the mechanical performance of a natural function, yet there are a set of cases which I, at least, am learning each year to respect more and more—on account of an unhappy experience with some of them—cases in which the necessary mechanical disturbance attending litholapaxy so stirs up the vesical neck—whether every fragment be removed or not—that cystitis more or less intense and prolonged follows the operation, and both the patient and surgeon come to regret that the more radical cutting operation had not been decided upon at first.

In this class belong (1) prostatic cases that have not used a catheter at all, or have not become habituated to the instrument; (2) most of the pallid, flabby, fat subjects, who show early the corneal arcus, and especially, it seems to me, (3) those who exhibit a tendency to recurring localized eczema (notably of the extremities) and to flatulent dyspepsia.

These cases, if properly prepared, do very well under lithotomy, and in them the supra-pubic method should be adopted, because it allows the surgeon to deal at a single sitting not only with the minor necessity—the small stone—but also with the more important and permanent disability—the enlarged prostate, by prolonging the supra-pubic lithotomy into a prostatectomy—and making the patient's necessity become the surgeon's opportunity.

On the Choice of Operation for the Removal of Stone from the Bladder. By L. BOLTON BANGS, M. D., SURGEON ST. LUKE'S AND CHARITY HOSPITALS.

Within the past few years the operation of Suprapubic Lithotomy has become so popular in the minds of surgeons and has met with such remarkable success, that for the present at least, the question may be narrowed between it and some form of Lithotrity.

The older methods of Perineal Lithotomy, median or lateral, seem to be almost entirely discarded excepting in the case of children. My own personal experience in this operation has been exclusively limited to children. Therefore in stating my own views I mean by the term Lithotomy, Suprapubic Lithotomy; all others being left out of consideration.

The Perineal Lithotrity of Dolbeau being extremely limited in its application and not having gained much of a footing in this country, I shall speak of *Lithotrity* only in two forms, one being the application of a crushing instrument to a small stone in an easily accessible bladder, the other form being that which is known by the term Litholapaxy; namely, repeated crushings at one sitting with as many evacuative pumpings till the entire stone is removed; the patient being under the influence of an anæsthetic.

The first of these is applicable to only a very limited number of cases, where, for instance, the stone is of recent formation or where it has but recently descended from the kidney, and having been retained in the bladder, is exercising an irritation upon that viscus. In such cases one application of the instrument either with or without an anæsthetic will usually crush the stone thoroughly and the few small fragments may either be removed by evacuating instruments at once or left to be expelled by nature's way. The second form, or Litholapaxy of Bigelow, being the one applicable to the vast majority of bladder calculi, I will venture to limit my share of the discussion to the indications for choosing between *it* and *Suprapubic Lithotomy.* The object of an operation is not only to remove from the body the cause, or active agent of suffering, but to do it safely and quickly without adding to the jeopardy of the patient; and also to place the patient in a state, which shall conserve his future health and well-being. Hence a given case must be approached without any prejudice in favor of one operation or another and the conditions under which the operation is to be undertaken must govern very largely the choice.

The age of the patient, his or her vigor, the conditions of the kidneys, bladder and prostate (if a male) must all be considered in turn. The relative mortality also of the two operations must be borne in mind. For, whereas at present we have a mortality in litholapaxy of less than 2 per cent., in suprapubic cystotomy (for all purposes) it is, according to the latest statistics, in the neighborhood of 5 per cent. Furthermore, the liability to relapse after litholapaxy especially in old men with atonic and catarrhal bladders associated with hypertrophied prostate, must also be taken into account.

In order to be more definite and to make clear the reasoning upon which the choice of operation should be based permit me to narrate briefly typical cases.

A man of about fifty years of age presents himself with the characteristic symptoms of stone in the bladder; namely, frequent and painful urination, with a varying amount of mucopus, and occasionally blood in the urine, the latter feebly acid in reaction; pain in the bladder, increased by vigorous locomotion or by jolting.

Upon examination, the bladder is found to be easily accessible to instruments, and a stone of medium size is ascertained to be within it. His general condition is good, and there is no evidence in the urine of any serious condition of the kidneys. There is no evidence of any prostatic hypertrophy, nor is there from the history any evidence of prolonged catarrhal inflammation of the bladder. With such a typical case it seems to me that an unhesitating decision should be given in favor of the crushing operation or litholapaxy.

Again, a man with the following history. He is fifty-six years of age, has had for several years a history of urinary disorder, *i. e.*, frequent, painful and bloody urination, the pain and frequency modified somewhat by intercurrent conditions of health, but of late his symptoms have been increasing in intensity to such a degree that he now seeks surgical aid.

On examination it is found that there is some difficulty in entering the searcher; that the depression of the handle of the latter, together with the presence in the bladder of two or three ounces of residual urine containing pus in moderate degree, indicates median hypertrophy of the prostate. Exploration of the bladder with the cystoscope, which can be readily done, shows that although the organ is trabeculated and has lost the glistening character of its mucous membrane, it is not sacculated or otherwise seriously affected organically and that there is but one stone within it. Moreover, examination of the urine, which is of a specific gravity of 1020–1022, reveals only moderate evidence of disease of the kidneys; *i. e.*, besides a small percentage of albumin, an occasional granular cast. His general condition is excellent and although he has been a sufferer from his bladder for several years he has not yet had much impairment of his vigor. Under these conditions I would again advise the operation of litholapaxy.

Take another case, in order to illustrate more definitely my proposition. A man aged seventy-two. Although several years older than the preceding patient his conditions are somewhat similar; *i. e.*, a moderate amount of prostatic hypertrophy, an uncomplicated bladder wall, and only a slight amount of evidence of degeneration of the kidneys. His bladder is easily reached by instruments, and is apparently accessible in all its parts. Moreover, there is but one stone present in the bladder and it is of a little larger size than the medium. In such a case I would also recommend the operation of litholapaxy.

With these three cases of different ages may be contrasted a case of a man aged only forty-five, in whom the following conditions are present:

There is no hypertrophy of the prostate, but there is an exceedingly sensitive and hyperæmic urethra and an exceedingly sensitive bladder, compelling him to urinate at frequent intervals. Any instrument, no matter how gently introduced, is grasped by convulsive contractions of the bladder, and a stone is found at the first searching; but all subsequent searchings fail to reveal any. There is no evidence of disease of the kidneys, but there is evidence of marked catarrhal condition of the bladder, which, associated with this convulsive muscular contraction, makes it strongly evident that besides the removal of the stone physiological rest must be secured for the viscus.

In this case accordingly I did a supra-pubic cystotomy and removed a stone which had been caught behind the pubes by this undue and irregular contraction of the bladder. Subsequent drainage, continued for a week or two, restored this individual to permanent health.

In this case, although the age and general conditions of the individual pointed to the simpler operation of litholapaxy, yet the bladder conditions were such that I felt compelled to choose the operation of lithotomy. Here, then, may be seen some of the specific conditions which render the choice of operation difficult, but which was finally decided by the condition I have quoted.

Now, in further illustration of the indications for choice, take another type of cases:

A man aged sixty-two who has had for several years pains over the pubes following each act of urination, pain felt at the head of the penis, reflex pains at different parts of his body and whose sufferings have become excruciating. Although a temperate man of good constitution and of excellent clinical history, he is losing ground rapidly and his vigor is being wasted by continual suffering. The introduction of a searcher into his bladder is attended with difficulty; not only a median but lateral hypertrophy of the prostate is found, and there are evidences in his urine of considerable degeneration of the kidneys.

In my opinion, although the lithotrite can be entered, the stone or stones seized and crushed and the evacuating instrument entered also, it is better, in view of the prostatic obstruction and the condition of bladder and kidneys, to do the speedy operation of supra-pubic lithotomy. This will not only be less likely to do damage to his already inflamed and softened bladder, but will give him the advantage of drainage for the relief of that inflamed organ.

In such a case my choice would be determined by the gravity of the bladder condition; because, although the stone might be easily crushed and removed, there would be a strong liability to relapse, even if only a small fragment happened to be left behind.

The cleaner and quicker the operation in such cases the better, and certainly in this respect the lithotomy is more desirable. I will admit that sometimes—although the symptoms of the patient seem to warrant the opinion that the bladder is uncomplicated, that but one or two stones of moderate size are present, and that all the indications point to litholapaxy—when we come to the operation itself this may be found to be of greater gravity than we had supposed. It has been my own experience in operating upon a patient aged seventy-four, upon whom a year previously the operation of litholapaxy had been done by a competent surgeon, to find within the bladder three large fragments left there after the previous operation, and in addition to find upon close inspection of the wall of the bladder a diverticulum or cyst in which was also a stone.

In another case, recently reported by me, I began with the operation of litholapaxy, but was obliged to convert it into a supra-pubic lithotomy, because a large fragment of stone jammed the prostate across the urethra, thus preventing the introduction of instruments.

In the one case I profited by the experience of a colleague, and in the other the cause of my misfortune was not cleared up until the bladder was opened. In each of these cases perhaps more careful antecedent exploration might have rendered the choice of operation more definite, and that choice would unquestionably have been the lithotomy.

The use of the cystoscope in such cases would in all probability have rendered the choice more definite. Therefore it seems to me that if any uncertainty as to the character of the bladder, *i. e.*, whether its walls are cystic or not, or whether the prostate presents any difficulties, remains in the mind of the operator and which cannot be cleared up by the cystoscope, the operation, which not only permits the removal of the stone, but affords a means of inspection of the interior of the bladder, should be the one chosen.

Another factor in making a choice should not be overlooked, and this is the manipulative skill of the operator.

Mr. Reginald Harrison, in comparing the supra-pubic and lateral operations, says: "There can be no doubt that the former proceeding will recommend itself to many practitioners on the ground that it is the simpler of the two, and if for this reason it is the more efficiently executed, no better ground can be advanced for its selection, provided that the same end can be obtained."

The same argument may be applied to the choice between the prolonged crushing operation of litholapaxy, which implies a certain amount of manipulative skill on the part of the operator, and in favor of the supra-pubic lithotomy, whose technique is very simple, and in these days of widespread knowledge of antiseptics is comparatively a safe surgical procedure.